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Combat Crew

strategic air command

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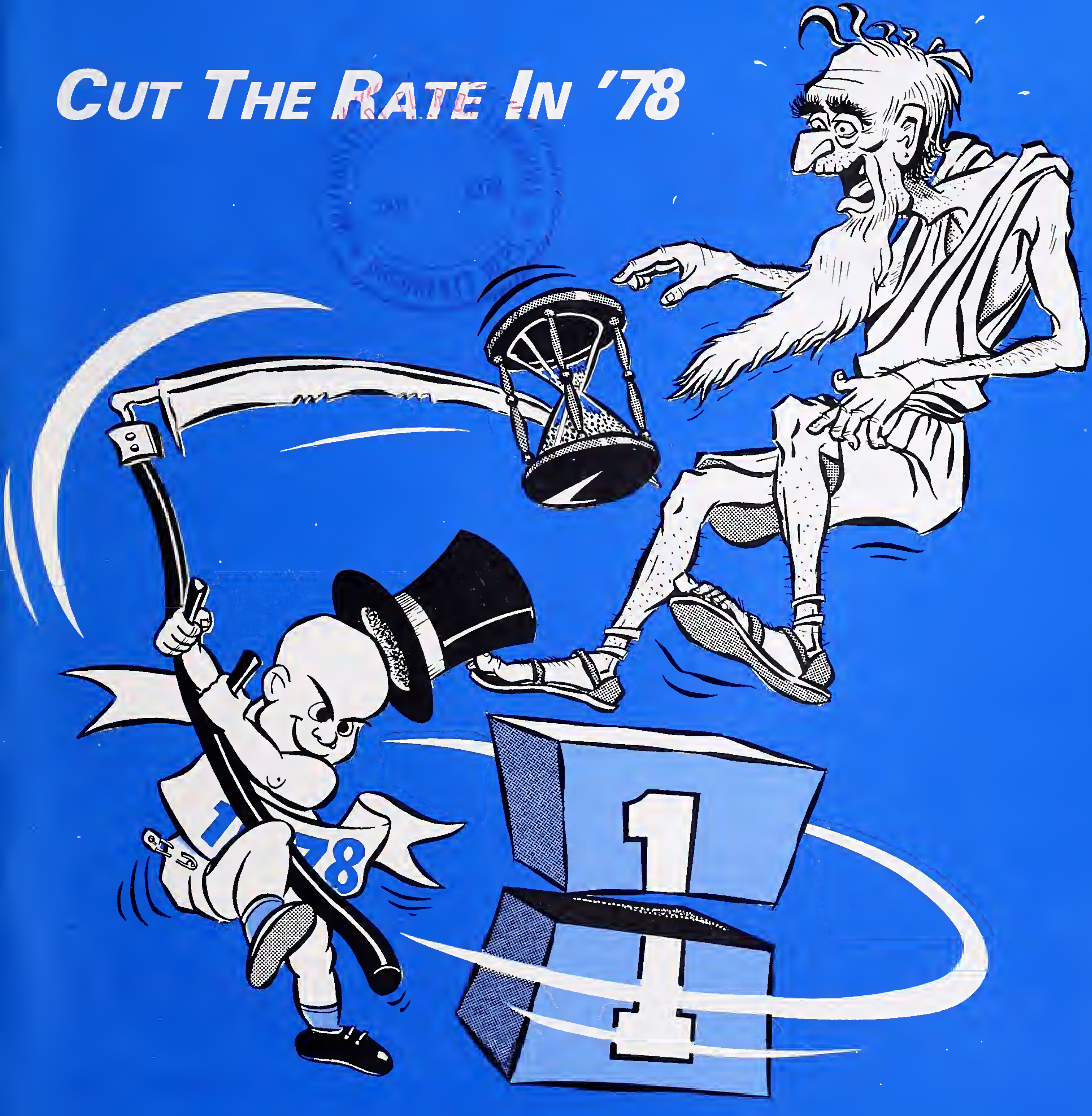
JANUARY 1978

CUT THE RATE IN '78



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YEAR END REPORT—1977

General Richard H. Ellis
Commander in Chief, SAC

The past few months we in SAC have witnessed an extensive national reevaluation of defense issues and changes in particular aspects of national security, some of which bear directly on the future of Strategic Air Command. These changes result from a number of interacting forces, but are centered around: defense perceptions, changes in the balance of U.S.-Soviet military power, and economic constraints. I would like to review for you some of these changes as they affect SAC.

Strategic Air Command is at a crucial point in its development, and in a manner much more critically important than any one system, no matter how significant it may be. For we are faced with some very serious concerns over the development and deployment of arms by our most formidable opponent, the USSR. As you well know, this momentum of growth over the last decade has not been limited to any one system, any one mission, or any one geographical area. The Soviet Union has been designing, developing, building, deploying, testing, and training in every facet of military endeavor for at least the last decade.

I suspect that the particulars of these events are not new to you, but I would like to review with you some developments which I consider most pertinent. These are, I would remind you, not speculations and projections, but facts about Soviet arms growth which are available to any citizen:

—Overall, both the quality and quantity of military power which the Soviet Union can bring to bear — regardless of mission, geography, or environment — have grown significantly in the past decade.

—In the strategic arena, Soviet aggregate strategic nuclear capabilities have increased roughly fivefold since 1964. Highlights of this growth include:

—The twin engine supersonic Backfire bomber, capable of attack against the U.S., is now being deployed in operational units and being produced at a rate of approximately two per month.

—A ballistic missile submarine fleet, the world's largest, being equipped with the Delta Class submarine, whose SS-N-8 missile has a range in excess of 4200 nautical miles — the longest range of any operational SLBM.

—The world's largest ICBM force — one third more missiles than ours, though presently armed with fewer warheads. The Soviets are now deploying three new ICBM systems (at a rate of 100-150 per year), and are developing four more ICBM models — a fifth generation. At the present rate, they can by 1985 have the capacity to place our own Minuteman missile force at considerable risk — though such an analysis does not consider interaction of other systems, which would affect any consideration to do so.

—This strategic consideration must also incorporate a Soviet civil defense program headed by a "Four Star" Deputy Minister of Defense directing a full-time staff of more than 100,000; an extensive Soviet air defense system which includes some 12,000 surface to air missiles and 2,600 interceptor aircraft; and, finally an operational Soviet anti-satellite capability which could threaten our space-borne warning, weather, and communications.

—In general purpose forces, Soviet momentum is comparable: During the past few years the Soviets have deployed forces sufficient to pose a real invasion threat to Western Europe.

—Their army has 300,000 more people now than it had in the early 1970s. On the whole this army is very well equipped, with new tanks, new self-propelled long range artillery, armored personnel carriers, ready to fight nuclear or conventional war and they are able to do so in a biological or chemical environment. Although numerical comparisons are not totally relevant, due especially to varying levels of arms quality and allegiance of allies, still the present ratios of Soviet to U.S. systems are worth noting:

- Tanks: Inventory, 5 to 1; Production, 6 to 1.
- Artillery: Inventory, 4 to 1; Production, 8 to 1.
- Armored personnel carriers: Inventory, 2 to 1; Production, 3 to 1.

—The Soviet Navy has been altered from what was 15 years ago essentially a coastal fleet to what is now a first class "Blue Water" force. The quality of Soviet ships on the high seas today is the approximate equal of that of U.S. ships, except for aircraft carriers. The USSR can now threaten our sea lines of communication in the North Atlantic, the Eastern Mediterranean, and the Western Pacific.

—In tactical air power, they have a modern, capable force which exceeds ours in numbers of aircraft by about 30 percent. Between 1964 and 1977 the Soviets have increased their aircraft numbers by about one-third and have doubled load carrying capacity. In Europe, they have in less than a decade turned a defensive tactical air capability into an offensive force capable of attacking any part of NATO Europe.

In isolation, there might be some doubt as to the significance of individual factors. But when we consider the total size, scope and momentum of Soviet military expansion, there appear to be several ines-

Continued on page 22

Combat Crew

Magazine of the Strategic Air Command - 28th Year of Publication

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ON OUR COVER

We herald the New Year with a firm committtment to reduce mishaps in all categories. Have a safe and Happy New Year.

SACRP 127-1 **VOL. XXVIII NO. 1** **JANUARY 1978**

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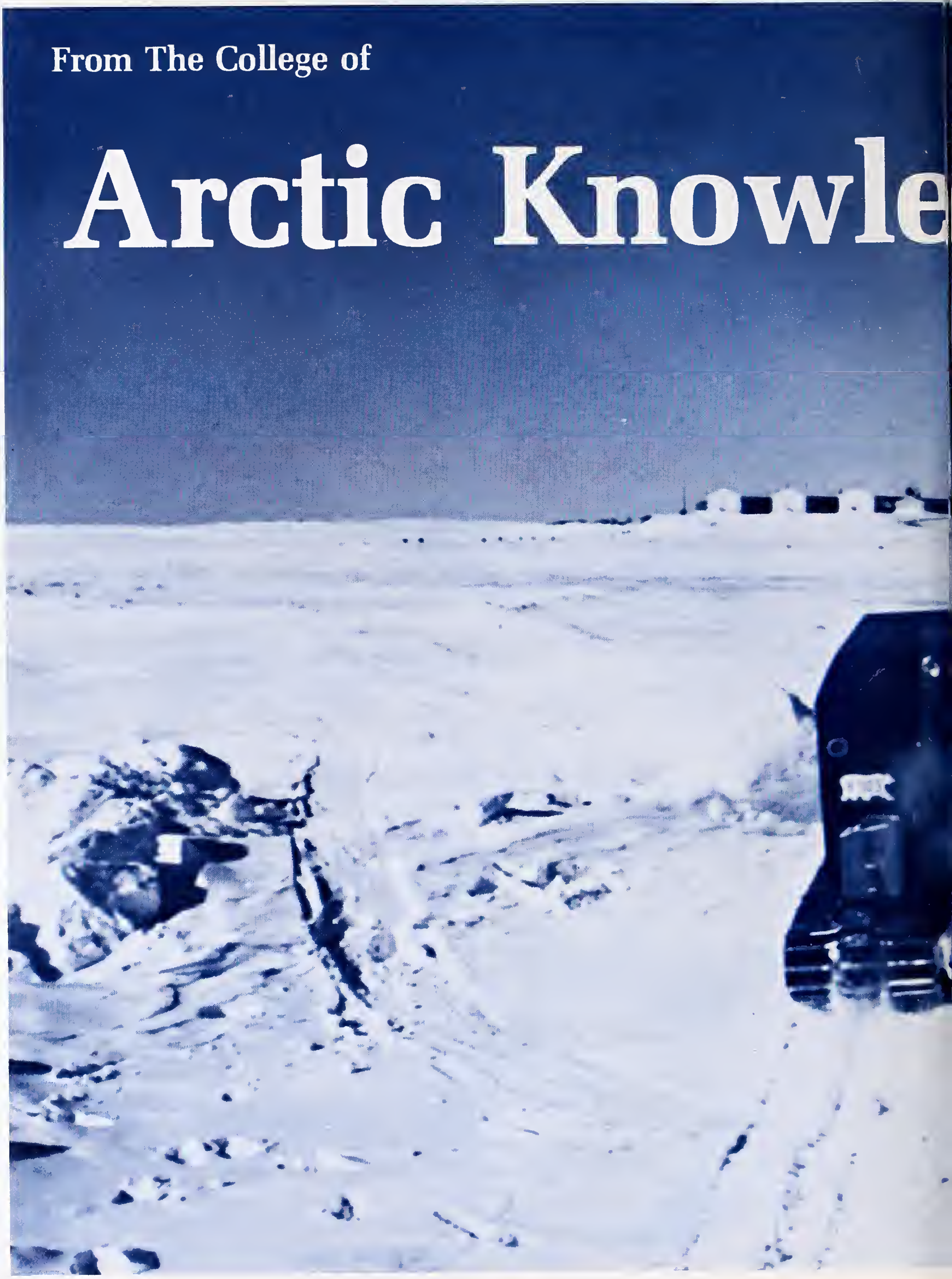
From The College of

Arctic Knowle



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Editor's note: The Arctic Survival School is known as the College of Arctic Knowledge — this article was written by the staff of Det 1, 3636 CCTW (ATC), Eielson AFB, Alaska.

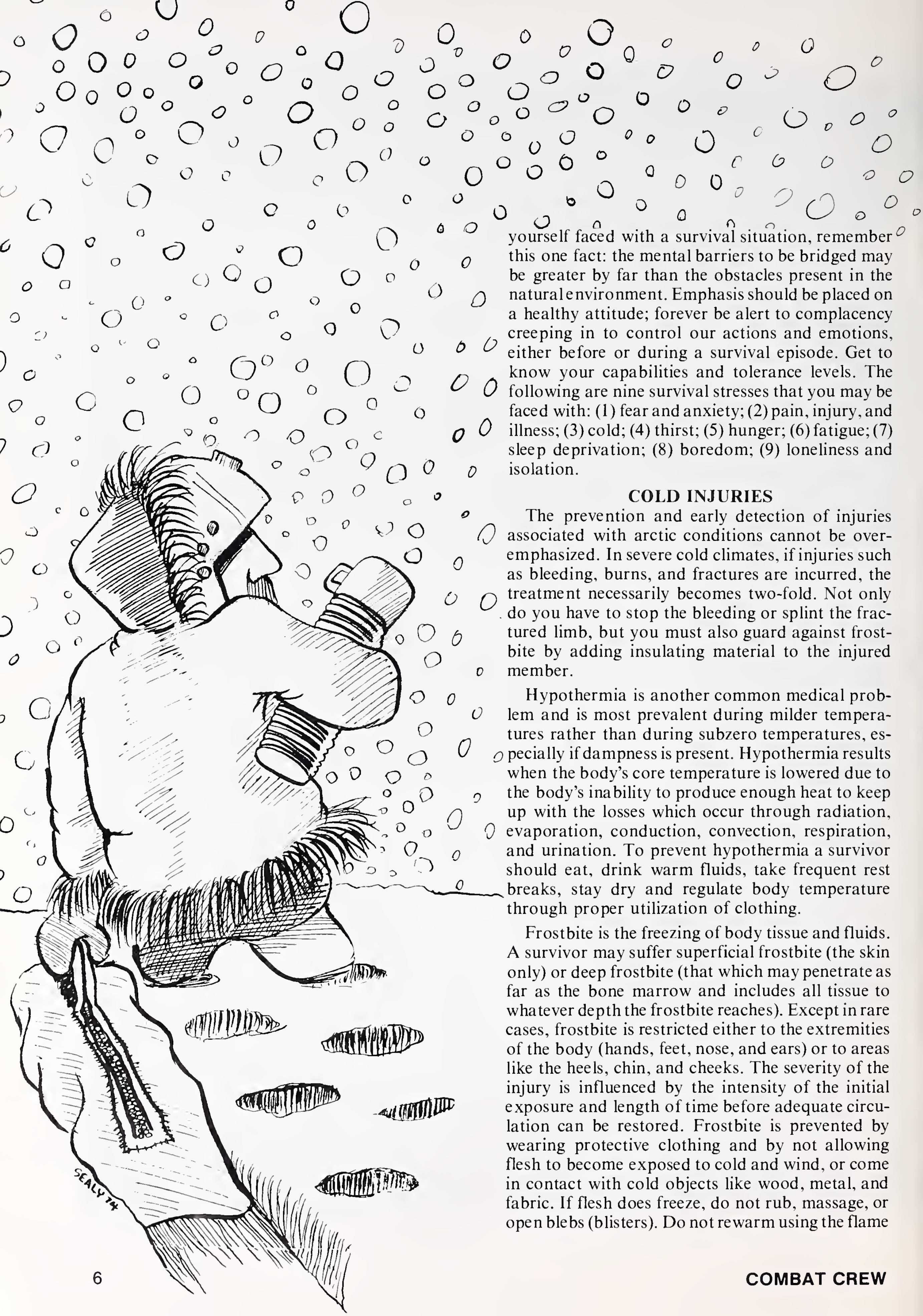
With winter pressing at our backs, let's turn our attention to the mental and physical preparations that we must achieve to insure a safe and healthy return of our aircrew members should an emergency arise. Military aircrew personnel are faced with the fact that mechanical failure, human error, weather, and, because we are in the armed forces, enemy retaliation may render our aircraft unsafe for human occupancy. Since such mishaps only happen to the OTHER GUY, many of us unconsciously drift into a state of complacency to become unprepared for an arctic survival episode. Don't be a Johnny-come-lately! Use the information discussed in this article to increase your survivability in the event you become the victim of an aircraft emergency.

Often, when involved in a discussion on arctic survival, we tend to limit the conversation to the geographical boundaries that encompass the north and south poles. To establish a practical extreme cold survival plan we must also include areas of high altitude where arctic-like conditions may also occur at any time of the year. Weather in extreme cold areas is so unpredictable, and can change so rapidly that all attempts of the UNPREPARED SURVIVOR may be of no avail. The long periods of darkness during the winter months and subzero temperatures require the survivor to be totally familiar with his life support equipment and well versed in such skills as shelter construction and firecraft if he is to survive.

PERSONAL PROTECTION

Personal protection, from a survival standpoint, might best be defined as those preventive measures taken to preclude both physiological and psychological injury or harm. Survival is MAINTAINING THE BODY TEMPERATURE! Personal protection in arctic or arctic-like environments may be more difficult than in other areas of the world due to the extreme harshness of the conditions to which the survivor may be exposed, but it is **not** an impossible task.

The tools for survival are furnished by the Air Force, by you, and by the environment. Survival training will provide you the skills and techniques. But tools and training are not enough; neither are effective without the will to survive. When you find



yourself faced with a survival situation, remember this one fact: the mental barriers to be bridged may be greater by far than the obstacles present in the natural environment. Emphasis should be placed on a healthy attitude; forever be alert to complacency creeping in to control our actions and emotions, either before or during a survival episode. Get to know your capabilities and tolerance levels. The following are nine survival stresses that you may be faced with: (1) fear and anxiety; (2) pain, injury, and illness; (3) cold; (4) thirst; (5) hunger; (6) fatigue; (7) sleep deprivation; (8) boredom; (9) loneliness and isolation.

COLD INJURIES

The prevention and early detection of injuries associated with arctic conditions cannot be overemphasized. In severe cold climates, if injuries such as bleeding, burns, and fractures are incurred, the treatment necessarily becomes two-fold. Not only do you have to stop the bleeding or splint the fractured limb, but you must also guard against frostbite by adding insulating material to the injured member.

Hypothermia is another common medical problem and is most prevalent during milder temperatures rather than during subzero temperatures, especially if dampness is present. Hypothermia results when the body's core temperature is lowered due to the body's inability to produce enough heat to keep up with the losses which occur through radiation, evaporation, conduction, convection, respiration, and urination. To prevent hypothermia a survivor should eat, drink warm fluids, take frequent rest breaks, stay dry and regulate body temperature through proper utilization of clothing.

Frostbite is the freezing of body tissue and fluids. A survivor may suffer superficial frostbite (the skin only) or deep frostbite (that which may penetrate as far as the bone marrow and includes all tissue to whatever depth the frostbite reaches). Except in rare cases, frostbite is restricted either to the extremities of the body (hands, feet, nose, and ears) or to areas like the heels, chin, and cheeks. The severity of the injury is influenced by the intensity of the initial exposure and length of time before adequate circulation can be restored. Frostbite is prevented by wearing protective clothing and by not allowing flesh to become exposed to cold and wind, or come in contact with cold objects like wood, metal, and fabric. If flesh does freeze, do not rub, massage, or open blebs (blisters). Do not rewarm using the flame of a fire. If superficial frostbite is the case, rewarm immediately using body heat. A survivor with deep frostbite should not rewarm the affected area when it is not known how long it will be before receiving clinical treatment.

It is good practice to enroll in a first aid course with emphasis on self-aid. After all, a lone survivor will be his own best doctor.

CLOTHING

Clothing is the first line of defense against any environment in which you may find yourself. Maintenance of body temperature can only be achieved through proper utilization of clothing. By doing this we prevent such cold injuries as hypothermia and frostbite. To accomplish this task we must know how clothing keeps us warm. The degree of warmth that clothing provides is determined by the amount of insulation. Insulation in clothing is nothing more than DRY, DEAD AIR held in between the fibers and the layers of clothing.

Both natural and synthetic materials used in clothing for insulation must be breathable so as not to cause condensation on the inside of the garment.

An acronym of the word COLD can help you to remember how to use and care for your clothing.

keep it Clean
avoid Overheating
loose and Layers
keep it Dry

We must keep it clean to prevent the entry of dirt particles into the fabric, which through friction would wear holes in the garment. Dirt also clogs the air spaces and causes heat to be lost by conduction. By ventilating when warm and slowing down our rate of work we can avoid overheating which causes the clothing to become wet from sweat.

Remember heat is lost 32 times faster through wet clothing than through dry clothing.

Many thin layers of clothing will be more effective in keeping your body temperature at a constant level than a couple of very thick layers. This will also allow you to add or remove layers as you get warm or cool off and not cause you to dampen the thick layers from sweat caused by wearing too much clothing for your activity.

The layer system is a very personal thing that must be experimented with by **YOU** to see what keeps you warm. Your ability to use clothing properly may make the difference whether you live or die.

Remember if you take care of your clothing and equipment it will take care of you when you need it.

FIRE

Many people have suffered unnecessarily, and in some cases died, because they waited too long before attempting to build a fire. (Read Jack London's short story — To Build a Fire.) As a result their fingers lost the dexterity necessary to hold matches, flint and steel, or other fire starting devices. DON'T WAIT! As soon as you recognize the need for a fire, get busy gathering the necessary materials.

Within the tree line fuels for fire are plentiful. Birch bark from birch trees, found throughout the northern regions of the world provide one of the best tinders for starting fires. Highly inflammable and easy to procure, it provides the foundation upon which to build. The lower dead limbs from spruce, the predominent evergreen in the north, provides the kindling. This abundant source of dry wood may be gathered by the arm load; ignites easily, producing both heat and light. Dead standing birch and aspen trees are a source of fuel. These may often be pushed over and carried into camp in large pieces. Chopping and sawing expend large quantities of energy, produce wasted heat and excessive sweat. In the treeless regions of the arctic, scrub willow and driftwood may be your only natural sources of wood.

While survival manuals and schools historically have advocated the use of primitive fire starting devices, i.e., flint and steel, NOTHING BEATS A MATCH for getting fire going quickly. M-2 Firestarters contained in some survival kits are another excellent fire starting aid. Metal matches, magnesium fire starting tools, flint and steels are also effective, but require a higher degree of skill to use and allow less time for practice under cold conditions.

In order for a fire to burn efficiently three things are necessary:

Heat — Initially that heat produced by firestarting device.

Oxygen — from the air.

Fuel — from natural resources, POL products, etc.

Continued on page 26

Missile Flight Control Center: foreground, MFCO's console note destruct switches in wells, background, telemetry strip chart recorders. (Right) Missiles launched from Vandenburg include the Thor, Titan II, and the Minuteman.

RANGE SAFETY IS ESSENTIAL . . .

AFTER LIFTOFF

Captain Carl Kaminski
Space & Missile Test Center,
Vandenberg AFB

The task force from Minot relaxes as the Minuteman III illuminates the Vandenberg coastline of the Western Test Range. Miles away in a dimly lit room a steady stream of reports flow to the Missile Flight Control Officer (MFCO). Seconds later, plotboards illuminate, tracing the bird's progress as the MFCO "flies" the missile toward a programmed splashdown in the Pacific over 4000 nautical miles away. Most likely he will only observe and evaluate incoming data; however, if necessary, the MFCO has the responsibility to insure the safety of people and property by terminating the flight of a malfunctioning missile.

Months in advance, extensive preparation began with a hazards analysis of the proposed flight plan

and modification of the operational missile for flight.

The planned launch trajectory was analyzed from many perspectives in relation to missile performance, maximum turn rates, weight changes with propellant consumption, breakup characteristics, and expected atmospheric conditions. A set of abort or missile destruct criteria resulted, which minimized hazards to the general populace. The abort lines, nominal trajectory, and pertinent geographical features were plotted on charts for display in the Missile Flight Control Center (MFCC) during the powered flight portion of the launch operation. At the same time, the missile was inspected for damage after its arrival at Vandenberg and then modified for launch. Instrumentation, beacon, and destruct packages were added.

The instrumentation package consists of a telemetry transmitter which sends missile performance data back to ground stations. This data is displayed as the flight progresses and recorded for post flight analysis.

The C-band beacon package aids radars in tracking the flight of the missile. The beacon is a receiver-transmitter, which emits a radio signal in response to the radar's interrogating signal.

The destruct package includes the command destruct receivers and destruct ordnance. The ordnance is located inside the raceway on the first three stages of a Minuteman III. On the fourth stage it is located on the fuel tank. Additionally, premature stage separation devices are added between all stages. These devices cause an automatic destruct if stage separation occurs earlier than programmed. The command destruct receivers provide the link between the ordnance and the ground-based command destruct transmitters (CDTs).

The MFCO uses the CDTs to terminate flight if the missile becomes hazardous. These UHF transmitters send out a constant tone or "check channel" to keep the receivers on board the vehicle "captured." This prevents any other transmitter from having the capability to destroy the missile. If destruct action is necessary, the MFCO toggles switches at his console which cause the CDT to send out a coded series of tones recognized by the receivers on board the vehicle and termination of flight results.

The flight termination options available to the MFCO depend on the type of missile involved. For liquid fueled boosters (i.e., Atlas, Titan, Thor), thrust may be terminated with an All Fuel Cutoff command. This allows the missile to fall to a lower altitude before destruct action is taken, thus confining the debris to a relatively small area. For solid fueled missiles, such as Minuteman and Scout, only destruct action is possible. An arming command preceeds destruct, preparing the CDRs for a possible destruct command. In either case, the destruct command is relayed from the switches at the MFCO's console to the ordnance on board the vehicle, through the command destruct transmitters and receivers.

All of the components involved, ground and airborne, undergo extensive testing during the series of pre-launch checks leading up to the actual launch date. On this day as the launch agency conducts its countdown, the MFCO runs pre-launch checks on instrumentation, insuring that all systems will be ready to support. The ground and airborne components of the destruct systems are verified during the countdown on both external and internal missile power. During these final destruct checks, the entire flight termination system, with the exception of onboard ordnance, is checked for proper operation. Following this final verification, flight termination system arming occurs thus closing the chain between on board ordnance and the destruct switches at the MFCO's console. While these destruct checks continue, final verification of all radar, telemetry, and computer systems which will support the launch continue. Concurrently, surveillance of the local area is conducted. Clearance of air, sea, and land is necessary before the MFCO will allow a launch to proceed. Only after all of these conditions are met and all systems ready to support does the MFCO send "green" status indicating clearance to proceed with the launch.

During flight the MFCO needs answers to two important questions: "Where is the missile?" and "What is the missile doing?" Four types of data received during flight provide the answers to these questions. Two MFCOs positioned outside, report on the early moments of flight, prior to radar acquisition. The Back Azimuth Skyscreen observer is located in back of the pad and on a line with the expected flight path. This individual confirms ignition, liftoff, and normal flight progression along the launch azimuth. At a right angle to the nominal flight trajectory is the Program Skyscreen Observer. He confirms that the missile pitches over or "programs" in the expected direction.

Colocated with both skyscreen observers are vans equipped with closed circuit television cameras operated by contractor personnel. The resultant pictures are transmitted by microwave to the MFCC. The reports from the skyscreen observers and these pictures are essential during the critical early stages of flight. Prior to radar acquisition (typically T+7 seconds) they represent the only data the MFCO has available on missile position and performance.

Telemetry strip chart data provides the earliest opportunity to anticipate nonnominal missile performance. Various data ranging from thrust chamber pressure and guidance command steering to the status of the command destruct receivers are transmitted from the missile and displayed on strip chart recorders in the MFCC. MFCOs acting as telemetry observers monitor these recorders and report anomalies to the MFCO.

The primary source of data is displayed on eight plotboards in front of the MFCO. Charts showing the local, midrange, and terminal areas in varying scales along with the planned path of the missile and the abort lines derived from preflight analysis are displayed on these plotboards. Data from radars are transmitted to computers which process the data and output two types of data for display on the plotboards. The first, Instantaneous Impact Prediction (IIP) data represents a point prediction of missile

Reentry vehicles launched from the Space and Missile Test Center at Vandenberg AFB (above) enter the atmosphere over Kwajalein more than 4000 miles downrange.

impact if flight were terminated at any particular moment. This dynamic prediction takes into account a multitude of factors including vehicle position, heading, velocity, acceleration and drag correction. The second, present position data plots the actual position of the missile at a particular moment in time. Based on the data presented on the plotboards and the verbal reports given him by skyscreen and telemetry observers, the MFCO monitors every launch from the Western Test Range.

Preparation for the complex task the MFCO faces requires extensive training. Prior to certification as MFCOs, personnel undergo a comprehensive one year training period. This includes work with support activities and instruction in classroom sessions held by qualified MFCOs.

To be eligible for missile flight control training an officer must hold the rank of 1st Lt or higher. His educational background must include a degree in science or engineering with a master's degree desired. One pilot and two former missile crew members are among the five MFCOs currently on assignment at Vandenberg. The remaining two possess experience with other developmental engineering programs with Systems Command. Their careful selection, training, and intensive concentration on all phases of missile flight safety have compiled a flawless record.

As a result, the Western Test Range, while supporting launch activities ranging from the ballistic Minuteman to the orbital Titan IIID booster, has compiled the safest missile test flight program possible and has repeatedly been awarded the Air Force Safety Award.

ABOUT THE AUTHOR: Capt Kaminski is a developmental engineer working as a MFCO at the Western Test Range. He has a bachelor's degree in engineering and a master's in business administration. His last assignment at Whiteman AFB as a missile crew commander included duty as an evaluator and instructor. In addition, Capt Kaminski represented the 351 SMW as an Olympic Arena competitor in 1974 and 1975.

ENGINE INFLIGHT MONITORING UPDATE

Lt Col James L. Pettigrew
HQ SAC/LGME, Offutt AFB

Editor's note: Three times in the last 18 months we published articles on the initial development and operational service test of this program. This update gives the results from 12 months of application in the SAC KC-135 fleet and initial progress on the application to SAC B-52 D/G/H and FB-111A.

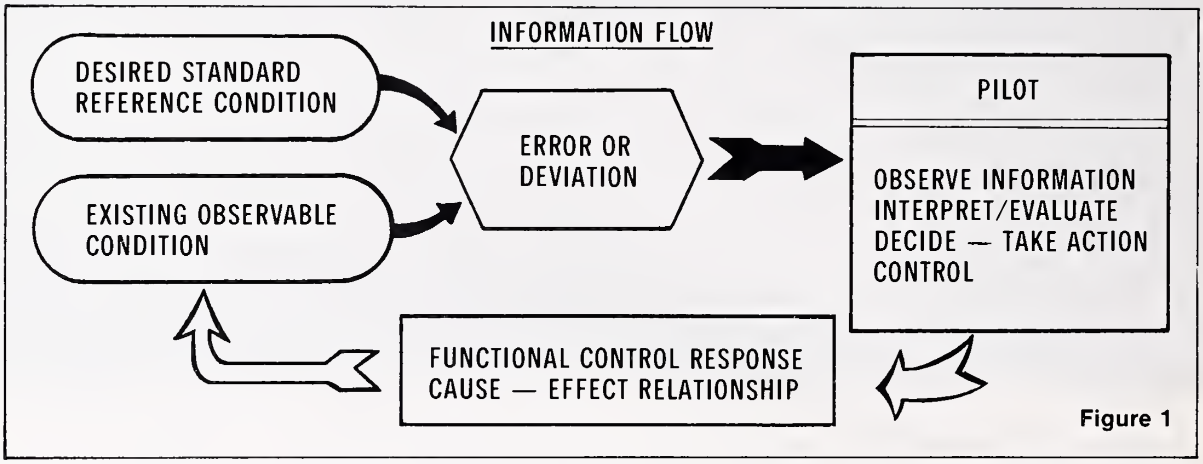

INFORMATION FLOW
DESIRED STANDARD REFERENCE CONDITION
EXISTING OBSERVABLE CONDITION
ERROR OR DEVIATION
PILOT
OBSERVE INFORMATION
INTERPRET/EVALUATE
DECIDE — TAKE ACTION
CONTROL
FUNCTIONAL CONTROL RESPONSE
CAUSE — EFFECT RELATIONSHIP

Figure 1

On 1 Oct 1977, application in SAC of the simplified engine performance monitoring program to -135 aircraft operations changed from engineering service test status to a routine way of doing business under the direction of SACR66-22, Engine Condition Monitoring Program (ECMP), dated 30 Sep 1977.

This change came about primarily because of your support of the engineering service test which produced results so startling that the program gained the attention of management at all levels.

In Oct 1976, the engineering service test was expanded to all SAC -135 units. Flight crew response was excellent with a set of readings provided from cockpit instruments on 89% of the SAC -135 flights. Maintenance specialists reduced your instrument readings to a trend format which could be readily interpreted. When engine performance data is converted to the trend format, the engines can talk about their aches and pains. By 1 Oct 1977, maintenance personnel using inflight data from all SAC -135 operations had reduced the SAC -135 fleet inflight shutdown rate from .30 per 1000 engine hours (1973-75 SAC average) to .15 for the service test year Oct 76-Oct 77. Other benefits from your data include:

- An estimated $12.7 million cost avoidance in potential secondary damage.
- Repair of 282 engines with serious internal damage not detected by flight crews, not validated by ground trim checks, but verified by teardown and visual inspection.
- Improved fleet condition from repair of over 300 bleed air leaks and correction of over 1400 cockpit instrument systems.
- Identification and validation of fuel nozzle plugging as the major unsuspected cause of premature engine failure.
- The results prove that inflight data from each engine's operating signature provides sufficient dynamic information to allow identification and early repair of developing engine problems. Aircrew Inflight Data Sheets (IFDS) are providing the basis

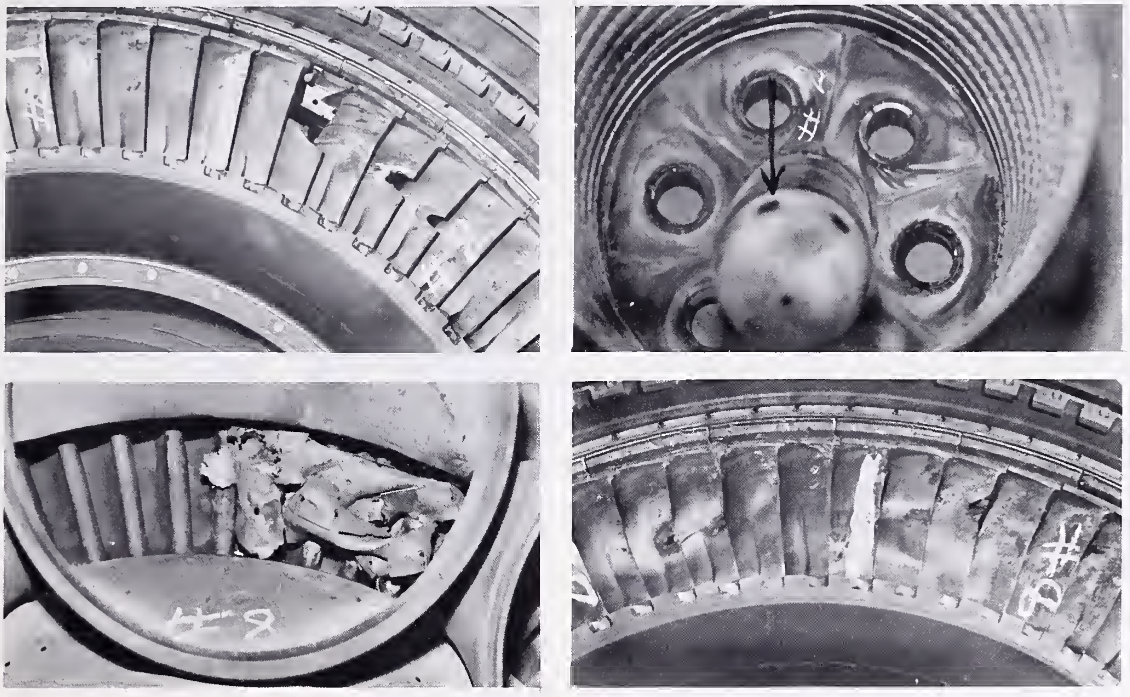


Figure 2 This engine passed test cell evaluation after replacing No. 2 and 3 turbine wheels and 25 third stage nozzle vanes. The engine stalled during on the wing trim.

for saving money and for helping to reduce exposure to operating engines with low reliability potential.

Dynamic data processing is the key to success in the Engine Condition Monitoring Program. Pilots routinely process information dynamically as they perform the tasks involved in flying. The process is error based because the pilot observes deviations between a reference and existing condition of a functionally related control parameter. The elements of the pilot's process are shown in Figure 1.

The method is not new, it is in fact similar to the Greek heuristic method which for centuries guided men in search of understanding. The power of the method comes from its cause-effect relationship observed in the fourth dimension (time). The repeated observation shows the dynamic results of control action through a real time feedback process.

The ECMP information flow is similar to that used by pilots, but different in two significant areas. The first area is the number of people (different specialties — flight crew, propulsion specialist, instrument specialist, crew chief, etc.) involved in the data flow. The second area is the amount of time required to see results of the corrective action that results primarily from the large number of people involved. The dynamic element of the pilot's control process can exist in ECMP only when each person completes his individual task in an accurate timely manner. The importance of each person's part cannot be overemphasized. J. Mason Knox summed it up well when he said, "It is not the guns or armament or the money they can pay, it's the close cooperation that makes them win the day. It is not the individual or the army as a whole, but the everlasting teamwork of every bloomin' soul."

Let's review two facts that your real time engine performance data has told us. First, the data has told us, and the information has been verified, that bad engines don't always run hot and fast. Flight crew inflight monitoring of engines has been based on limits which work, but only after engine failure. Engines with serious internal damage will run well within the limits as specified in technical orders. The fact that incomplete engine valuation criteria were verified by ECMP illustrates the power of dynamic information systems.

The same applies to ground test criteria. An engine can trim within limits of EGT, data plate speed (maximum allowable N2 speed), and EGT spread in accordance with existing tech data and not, in fact, be a serviceable engine. Such a statement is contrary

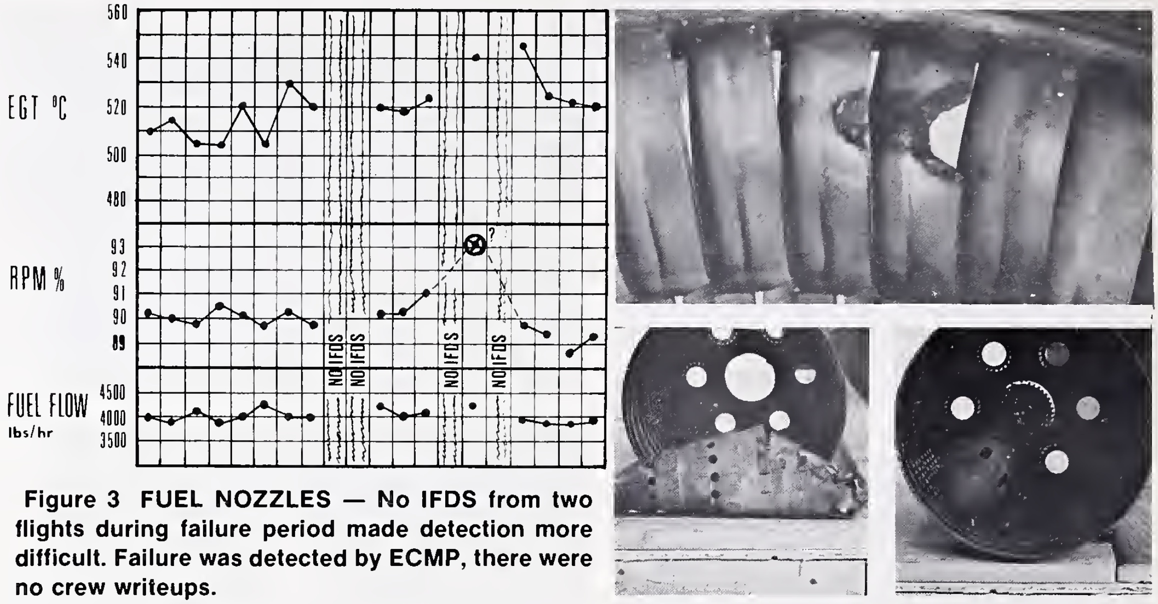


Figure 3 FUEL NOZZLES — No IFDS from two flights during failure period made detection more difficult. Failure was detected by ECMP, there were no crew writeups.

to long accepted beliefs. Hard facts are that inflight data has shown that bad engines can sometimes ground test satisfactorily.

The assumption that engine deterioration and loss of internal efficiency will result in an engine running with higher EGT seems on the surface to be very sound and logical. However, an unsuspected phenomena becomes apparent when the engine is isolated as a free body (in flight) and analyzed as a system.

Deterioration in the N2 rotor turbine will cause its speed to drop. Therefore, the fuel control will schedule more fuel. This increases the energy in the airstream leaving the N2 turbine which increases the speed of the N1 rotor. Since the quantity of air drawn into the engine depends on N1 compressor rotor speed (which has increased), then more air must leave the engine. Our aircraft do not have cockpit tachometers for N1 rotors; so there is no way of seeing any change in N1 rotor speed. The engine exhaust nozzle takes care of this job; but the nozzle is usually operating at its maximum. In terms of airflow, it is choked. This means that the tail pipe is incapable of exhausting the increased airflow regardless of how much the EPR is increased.

Tail pipe pressure divided by ambient pressure is engine pressure ratio (EPR) which is the pilot's functionally related engine control parameter. He observes an increase in the existing EPR and retards the throttle to eliminate the deviation. The result is rated EPR at lower N2 rotor speed with the EGT remaining the same, going slightly up or down depending on the degree of deterioration.

Dual rotor jet engines operating with EPR above 1.9 (equivalent to an exhaust nozzle critical pressure of .53) will not necessarily run hotter and faster as they develop problems within the turbine section. Engine limits for flight and for ground test do not by themselves identify engine problems. Figure 2 illustrates the degree of internal damage which would be within cockpit instrument limits and would be certified as airworthy by maintenance specialists. This is because of incomplete ground trim evaluation criteria in the tech order. Because aircrews have provided maintenance personnel with dynamic inflight engine performance data, existing ground trim evaluation criteria has been identified as being incomplete. Additional procedures have been developed which promise to provide needed ground trim evaluation capability.

A second significant discovery from ECMP is the initial mode of premature engine failure. Fuel nozzles fail to work correctly long before our engines reach their established hard time inspection intervals. Plugged fuel nozzles affect engine operation much like turbine deterioration. The engine runs at slower N2 rpm because the turbine inlet temperature is lower behind one or more of the eight burner cans. More fuel goes through the good nozzles and causes their burner cans to run hotter. The increased temperature sometimes exceeds the structural capability of the metal. Most combustion can liner failures are preceded for a hundred or more flight hours by plugged fuel manifold nozzles. This problem has been identified and effort is being expended to provide a better fuel nozzle capability.

Service tests of engine monitoring for B-52/D/G aircraft were started in May 1977. By 1 Oct 1977 the following results had been reported:

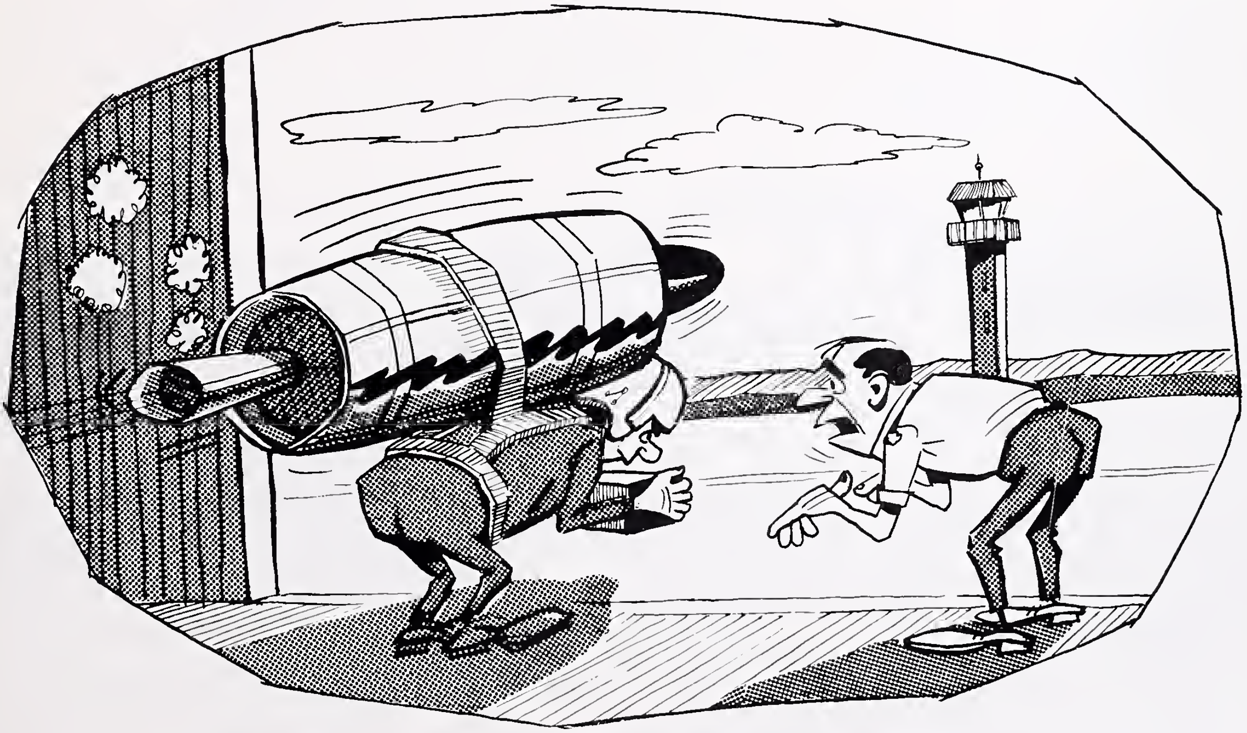
- Flight Safety. Sixty-five potential engine failures were identified and fixed before any flight crew writeups.
- Improved Mission Capability. Inflight shutdown rates were reduced one-third for the B-52D and one-half for the B-52G.
- Improved Equipment Condition. Over 460 engine related problems were identified and repaired (bleed air leaks, instruments out of calibration, etc).
- Cost avoidance from reduced secondary damage $4.2 million plus.

The B-52H ECMP service test was started in Oct 1977 and the FB-111A ECMP service test in Dec 1977. Technical evaluation of methods and correction factors should be completed and all SAC tactical aircraft brought under SACR 66-22 by the end of 78. The engine condition monitoring program can be better than 95% effective in predicting engine failure in early stages of development. To gain this advantage, your support with accurate and consistent recording of inflight data is required. Statistical significance requires IFDS from a minimum of 70% of the sorties flown. IFDS from more than 90% of the sorties flown will improve our capability to find and fix engine problems before you discover them inflight. See Figure 3 for an example of how lack of inflight data could put you in an aircraft with an engine failure at a critical time. Mission requirements have priority over completing an IFDS; but what are your priorities regarding your flying engines with serious internal distress?

The SAC Engine Condition Monitoring Program is now producing over $2 million dollars per month cost avoidance and improving the reliability of SAC engines.

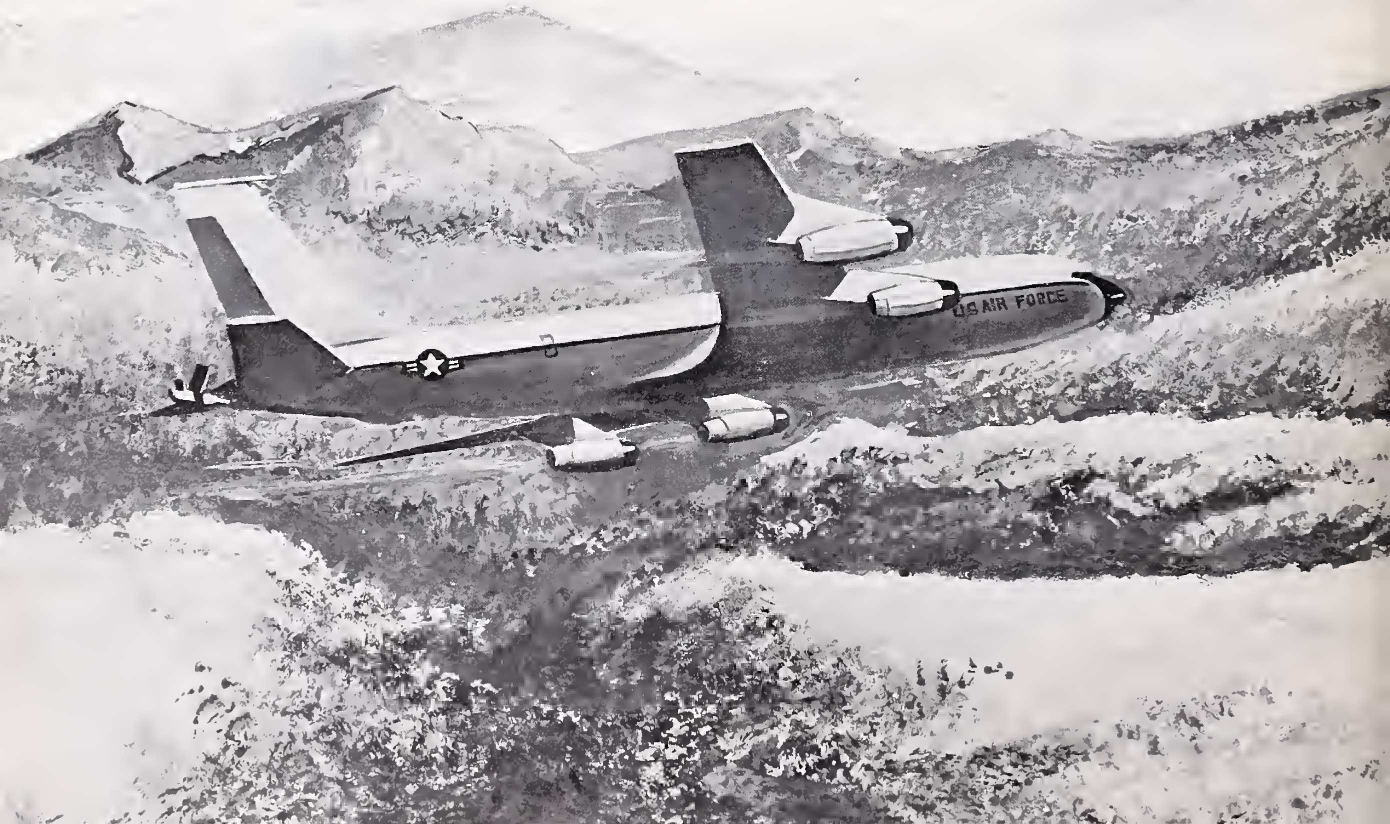
Interim reduced power takeoff procedures which lowers the severity of engine usage have been provided for each type aircraft. The reduced power takeoff coupled with ECMP can provide safe engine operation beyond current hard time maintenance intervals. These two factors will provide SAC with reliable propulsion systems at a lower life cycle cost.

We in the aircraft engineering division are proud of aircrew participation in the ECMP. Your dedicated efforts and faith in the program have helped to convert our ideas into results. Keep up the good work and remember the value of team work.



I agree, you're a top notch engineer Col Pettypoop. But there has to be an easier way of proving your Engine Inflight Monitoring Theory.

High Terrain NORTHWEST



Editor's note: The following is an adaptation of a National Transportation Safety Board information release. Put yourself in the cockpit and visualize how you would interpret and react to the IFR clearance.

According to the National Transportation Safety Board report, the crash of a chartered jet in which four persons were killed was caused by the crew's failure to properly interpret their flight clearance.

The aircraft took off from runway 30 at Palm Springs on an IFR clearance to Las Vegas. About five minutes later, the aircraft crashed in the mountains at approximately 9700 feet, 22 miles northwest of Palm Springs. The local weather observation indicated a ceiling estimated at 3000 feet, broken, 5000 feet overcast, visibility 8 miles, light rain, wind calm.

The jet's air traffic control clearance required it to

HIGH TERRAIN NORTHWEST

make a right turn after takeoff and position itself on a straight line course between Palm Springs and Twenty-nine Palms. The aircraft was to maintain an altitude of 9000 feet and was told to report "crossing" the Palm Springs VORTAC 051 degree radial 10-mile fix.

The Board's investigation showed the plane took off, climbed to 9000 feet, but never changed its runway heading and flew directly into the mountains, killed the two-man crew, and two passengers.

About five minutes later the aircraft crashed in the mountains.

"The National Transportation Safety Board determines the probable cause of the accident was the flight crew's misinterpretation of an IFR clearance issued by the Palm Springs Departure Control and subsequent Air Traffic Control instructions.

"Contributing to the accident was the controller's failure to detect the aircraft's deviation from the route of flight contained in the ATC clearance and the flight crew's failure to recognize their proximity to the high terrain."

At 1654:10 the FAA local controller cleared the aircraft for takeoff and to maintain "niner thousand." After the aircraft was airborne the crew contacted Palm Springs departure control and reported "out of" 1,500 feet and climbing to 9,000 and the controller requested they report reaching 9,000. The controller then requested the flight to "report crossing 051 radial 10 mile fix." The flight responded "okay" and ten seconds later the controller transmitted "and that's the Palm Springs 051 radial, sir," and again the flight responded "okay."

Subsequently, at 1656:25 the crew reported they had "crossed the radial." The crew did not specify the "Palm Springs 051 degree radial" or the "10 mile fix," both of which were included in the clearance. The Board said that the flightcrew's report that they had crossed the radial "was erroneous" because the Palm Springs 051 degree radial exists in the northeast quadrant of the VORTAC and the flight never entered that area. The Board concluded that when the crew reported they had crossed the radial they were actually crossing the Palm Springs 231 degree radial which is the reciprocal course of the Palm Springs 051 radial. At the same time when the controller received this report he "assumed" that the crew were crossing the Palm Springs 051 radial at the 10 mile fix, as specified in the clearance.

The Board said it is difficult to rationalize how the flightcrew concluded that the runway heading of 300 degrees — which led them from the point of takeoff directly into the mountains — was to be maintained. The Palm Springs controller cleared the flight, in part, to Las Vegas "via Palm Springs, direct Twenty-nine Palms." Based on the existing regulations the Board concluded that the pilot was required to fly on the straight line course between these two points, which meant turning off the 300 degree runway heading as soon as practical after takeoff. The controller had specifically defined the point at which the aircraft was to report along its cleared route; crossing the Palm Springs 051 degree radial "10 mile fix." "There was no way this fix could be reached by maintaining the runway heading," the Board said, "and no request was levied on the flightcrew to hold runway heading after takeoff."

. . . the probable cause of the accident was the flight crew's misinterpretation of an IFR clearance.

The Board noted that one possible explanation for the crew's misinterpretation of their clearance could have been that the crew was unaware they were operating in non-radar environment and believed they were under radar control. However, at the time of the accident the Palm Springs Tower had no radar capability. Consequently, until the aircraft reached about 9,000 feet — the lowest altitude that the Los Angeles Center radar could pick up its transponder target — no radar information was available to monitor the flight's progress. It was not until "just before impact" that the Los Angeles Center's radar picked up the aircraft on their radarscope but there was not sufficient time to establish radio contact with the flight and vector it away from the mountain. Thus, without radar, the Palm Springs departure controller's knowledge of the aircraft's position could only have been based on the route for which he cleared the aircraft — and the pilot's progress reports.

In commenting on the flightcrew's "failure to recognize their proximity to high terrain," the Board pointed out that "proper exercise of responsibility" during descents and takeoffs can only be based on knowledge of terrain hazards. However, in this case, the pilot was familiar with the Palm Springs airport and its surrounding terrain. Thus, the Board said, it could not explain the pilot's continuance of a heading that, if maintained would aim his aircraft toward the highest mountain in the area and at an altitude more than 2,000 feet "below" the highest terrain. *The Board did note, however, that several aircraft accident investigations have indicated that, since the advent of radar control and its capability to vector traffic, there has been "a derogation of pilot knowledge of terrain over which they fly."*

. . . no radar information was available to monitor the flight's progress.

In commenting on the controller's failure to detect the aircraft's deviation from the route contained in the air traffic control clearance the Board noted that at 1656:55 the crew reported they were approaching 9,000 feet and asked if they were cleared "via" the 051 degree radial to Twenty-nine Palms. The controller replied in the affirmative and added "I had a change of route there. Maintain 9,000, I'll keep you advised." The crew then asked if they were to maintain 9,000 feet "straight ahead, right?" and the controller said they were. The controller's use of "I had a change of route there," appeared to confirm their belief that their present heading (approximately 300 degrees) was to be maintained until they received clearance to "turn back" toward Twenty-nine Palms and "intercept" the 051 radial.

On the other hand the controller stated that when he said he would "keep them advised" he was only considering the "altitude restriction" of 9,000 feet. Moreover, since the controller was convinced the flight was already established outbound on the 051 radial course the query about flying "straight ahead" merely meant "continued flight" toward Twenty-nine Palms on the 051 radial. The Board noted that during this exchange the flightcrew did not apprise the controller of one vital piece of information — their heading, or direction of flight.

Subsequently, at 1658:30 the crew reported they were about 14 miles from Palm Springs and maintaining 9,000 feet on a heading of "three one zero" and asked "what's our clearance from here." This was the only transmission from the flightcrew that gave the controller "heading information" the Board said, and a chance to make a reasonably accurate estimate of the aircraft's position. However, the Board said, the controller did not recognize the significance of the 310 degree heading or it did not register with sufficient impact to overturn his conviction that the flight was on the 051 radial heading and proceeding toward Twenty-nine Palms.

The defects in communication procedures uncovered in this accident appeared in several earlier accidents.

The same defects in communication procedures uncovered in this accident appeared in several earlier accidents, the Board said. As a result, on July 25, 1977, the Board recommended that the Federal Aviation Administration require a controller who issues an altitude assignment, or a heading, to require the crew to read back the clearance — if the pilot fails to do so on his own. The Board also recommended that the FAA alert its personnel to the circumstances surrounding the Palm Springs accident in an effort to prevent any possible recurrence.

Single copies of the Safety Board's complete report may be obtained without charge by writing to the Publications Branch, National Transportation Safety Board, Washington, D.C. 20594. Multiple copies may be purchased by mail from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22151.

LEST WE FORGET

Major Herman L. Reese
Hq SAC/DOSM, Offutt AFB

This month marks a ten year achievement for the Strategic Air Command. It has been exactly ten years since a nuclear accident involving SAC resources has occurred. On 21 January 1968, a B-52 departed a SAC base on a 24-hour airborne alert mission with a combat ready crew that had trained and flown together as a unit. An additional pilot was aboard to insure adequate rest for the primary crew. The aircraft had no outstanding maintenance writeups or inspection requirements. The mission was routine until one hour after aerial refueling when the cabin temperature became too cool for crew comfort. As a result, the emergency right-hand inboard position was selected to provide cabin air and the temperature rheostat was rotated to the maximum heat position. This action provided a source of very hot air. After the initial setting was made, the rheostat setting was decreased because other crewmembers reported they were getting too hot. One crewmember detected and reported the odor of burning rubber. As fumes quickly grew stronger, the aircraft commander directed the crew to go to 100% oxygen and locate the source of the fumes. At that time the air bleed selector was repositioned to the normal setting. In searching the lower crew compartment, the navigator found a fire when he moved a metal box aside. He quickly alerted the other crewmembers and started using a fire extinguisher on the flames.

The pilot notified a nearby air base, Thule Air Base, Greenland, of the fire in the cabin and requested an immediate descent for an emergency landing. The navigator had little success in containing the fire and had expended both available fire extinguishers. Shortly after a descent was started, all electrical power was lost. The bail out order was given by the aircraft commander and executed by the crew. The aircraft impacted on the Arctic ice of North Star Bay approximately seven miles off the coast of Greenland and Thule Air Base. The aircraft disintegrated on impact and explosions and fire followed. Of the seven persons aboard, six survived. Although nuclear weapons were on board the aircraft, there was no nuclear detonation since the design features of the weapon precluded a nuclear reaction.

The cleanup operation, Project CRESTED ICE, which followed this mishap has been unmatched in SAC history. Long lines of airmen, used to recover the weapon and aircraft debris, faced hazards from both the accident and the environment. Heavy equipment operating on the sea ice frequently broke down due to the extreme cold, and during the early recovery operations, storms repeatedly swept the area.

The recovery portion of Project CRESTED ICE officially terminated on March 30, 1968.

On the morning of January 17, 1966, a similar mishap occurred over the southeast coast of Spain when a B-52 collided with a KC-135. The two aircraft exploded and the wreckage fell in the vicinity of the seacoast town of Palomares. Four members of the B-52 crew were able to parachute to safety; three of them landed at sea and the other on shore. No one in the KC-135 survived.

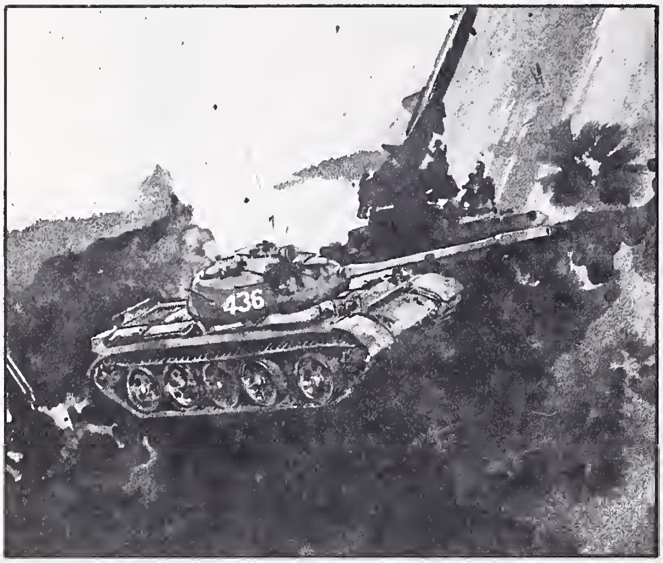
The B-52 carried four nuclear weapons, three of which were located by search teams within the first 24 hours of search. The only portion of the fourth weapon located was the tail plate to the parachute compartment. On 22 January 1966 the U. S. Navy was requested to assist in locating the missing weapon which might have fallen into the sea.

Air Force search teams combed the region ashore while the Navy initiated one of the largest deep sea search and recovery operations ever conducted. Ground search parties walked arm in arm over a vast area. Steep mountains required the search teams to be lifted to the tops of the mountains by helicopter and then descend the sides on ropes. More than 800 abandoned mine shafts, cisterns, wells, caves, and other openings were examined to determine if the missing weapon had fallen into one of them. Search teams analyzed the debris pattern and computed the probable trajectories of the weapon. Two weapons had fallen without their chutes deployed and were found two miles inland along the flight path of the aircraft. They had sustained high explosive, single point detonation upon impact and caused some minor contamination of the surrounding area. The third weapon had a streamered chute and landed in a field close to the beach. The fourth weapon was finally located in mid-March and was recovered on 7 April from a depth of 2850 feet, five and one-half miles off shore.

Other accidents involving nuclear weapons have occurred; however, an accidental nuclear detonation has not occurred. Safety features are designed into the weapon with stringent quality and reliability controls by the Energy Research and Development Administration (ERDA). The Air Force is responsible for safe and secure operation external to the weapon. The USAF Nuclear Safety Program provides the tools for safe nuclear weapon procedures in the logistical and operational environment and in the maintenance and operation of the weapon system.

Nuclear mishaps not only decrease unit efficiency, but deprive us of dollars, material, and valuable human resources that we can ill afford to lose. The constant and sometimes routine tasks of storing, transporting, loading, and standing alert with nuclear weapons must not cause us to forget the awesome potential for destruction. Nuclear safety does not just happen. We in SAC operate on the philosophy that we can prevent any accidental nuclear detonation. Nuclear safety is absolutely essential in the vital task of maintaining the Strategic Air Command's mission capability.

ABOUT THE AUTHOR: Major Herman L. Reese is the Nuclear Safety Program Manager at Headquarters SAC and is responsible for the nuclear safety program throughout the command. He entered military service through OTS in 1965 and had his first operational assignment at the 351SMW, Whiteman AFB; during this assignment he served as a member of the SAC Disaster Response Force during Project CRESTED ICE. While assigned as the Chief of Missile, Nuclear and Explosives Safety at Incirlik Air Base, Turkey, he received the 16th Air Force Weapon Safety Award. He has served as an instructor, Missile Combat Crew Commander, and OIC, Recurring Crew Training and Upgrade Crew Training in the 341SMW, Malmstrom AFB. Major Reese is a graduate of Squadron Officer School and has earned a Master of Business Administration degree through the Air Force Institute of Technology.



Illustrations courtesy of Airman.

YEAR END REPORT–1977

Continued from page 3

capable conclusions: (a) Overall Soviet strategic nuclear capability is now on a par with that of the U.S.; (b) Overall Soviet conventional military force is quantitatively greater than that of the U.S. and in some areas considerably exceeds ours; (c) the momentum of this Soviet military expansion in relation to our own present and projected forces makes it clear that we could fall behind in some aspects of our military posture. Such an outcome has been stated as unacceptable by the majority of the people, the President, and the Congress of the United States.

The appropriate and most economical way to solve this problem would be through workable negotiated agreements with the Soviets. Pending this eventuality, however, our nation must take whatever steps are necessary to maintain the overall military balance.

For Strategic Air Command, this translates into a dual requirement of readiness. In the first instance, we must maintain and update our strategic nuclear capability. Since strategic capability revolves around major systems — the TRIAD — we can note several steps necessary to maintain strategic equivalence in the near term:

—Modify SAC B-52s to accommodate the air launched cruise missile and advance this system to operational capability as rapidly as possible in order to strengthen the air-breathing leg of the TRIAD.

—Maintain the Minuteman ICBM in the best possible operational condition, concomitantly proceeding with development of the M-X missile. We must be prepared to deploy M-X by the mid-1980s in order to negate the projected Soviet capability against our Minuteman missiles.

—Continue to explore the advanced bomber option. Eventually the B-52 must reach the point when it is too old, both chronologically and technologically, to perform its appointed tasks. If there is still a need for the manned penetrating bomber at this point — and, based upon our projections, I am confident that there will be — we will then need a new manned penetrator. The bomber's total applicability to both conventional and nuclear roles means that we will continue to require a vehicle with similar flexibility for the foreseeable future.

—Find better methods to assure the survival of strategically important space assets. As you know, Strategic Air Command relies heavily on space systems for information and warning. Time can only increase this reliance. While continuing to comply with space treaties in effect, we must assure ourselves that systems and procedures are adequate for our strategic mission in any eventuality. The existing Soviet operational anti-satellite capability reinforces this need.

In the second instance, we in SAC must be capable of rapidly responding to world-wide requirements for our conventional support. SAC presently has considerable potential for assistance in the deterrence and repelling of conventional attacks. But improvements in our existing capabilities are possible. As Secretary of Defense Brown has noted, "Strategic parity has not banished the use of all forces; it has simply made the possible use of the more traditional types of force by our adversaries more tempting."

There are several facets of SAC capabilities tailored for the conventional role. Most obvious is the use of B-52 bombers for conventional deterrence and conflict. The B-52D model, which can carry up to 60,000 pounds of munitions, offers a significant present capability and the potential for broadened force application. With improved weapons and avionics it can be used for many additional ground and naval support roles. I know of no other system that can approach its potential for near-immediate response to attack with tremendous firepower against targets at even the most distant points on the globe, especially where we have little or no military presence or support facilities.

These bombers have utility as a visible "show of force," to deny an army access to strategic areas through mining or direct conventional attack, and as support in airborne electrocountermeasures. In ocean areas, the B-52 can perform long range sea surveillance, mine laying, and engage in anti-ship and anti-submarine warfare. The support we can provide theater commanders is not yet fully adequate in all these areas, but great potential is there, which we are working to realize. In dedicating the B-52D to such a role, we will still maintain the D as a part of our nuclear deterrent. This B-52D utility in the conventional arena may well last beyond its effectiveness for other roles.

Allied to the conventional bombardment growth is the requirement for SAC — as the single manager for U.S. aerial refueling — to provide greater refueling support for strategic, tactical, airlift, and naval aircraft during world-wide contingencies. We are devoting more and more of our refueling sorties each year to support of operational and training missions of other commands. A future system promising some assistance in both refueling and air cargo capacity is the Advanced Tanker/Cargo Aircraft (ATCA) now under consideration by the Department of Defense.

Within conventional conflict considerations there can also be requirements for SAC support in reconnaissance, intelligence assessment, and command control. Reconnaissance aircraft assigned to SAC — the RC-135, U-2, and SR-71 — have unique capabilities for gathering essential elements of intelligence information for theater commands, as well as for SAC. This information can be analyzed rapidly and efficiently (with computer assistance) by SAC Intelligence personnel.

Our existing world-wide command control capabilities assure other commanders of SAC support precisely as they require it, with changes rapidly implemented through SAC centralized control.

It should be clear that some of the changes I have noted as being underway or expected will require substantial changes in orientation and systems. SAC has just turned a new corner. We have a great deal to do and we must do it in the face of an extensive military threat, constrained by austerity in defense funds and energy limitations perhaps not previously equalled. Someday, perhaps negotiated settlements can bring us a world without nuclear weapons. Until then we must remain attuned to the dynamic requirement for strategic balance and stability in a still dangerous world. Our work is cut out for SAC. For us 1978 denotes a new beginning. We must get to it. ★★★★

Illustrated by TSgt Gary F. Miller and TSgt Patrick O. Gjerde.

r&d corner

HQ/SAC — DIRECTORATE OF AERONAUTICAL REQUIREMENTS

Maj William D. Fritz Jr
HQ SAC/XPHN, Offutt AFB

15 MARCH 77. It was a clear morning with visibility unlimited. The sun had just begun to peek over the horizon as a B-52H turned to a heading of 180 degrees. Inside the crew was preparing for the work at hand as seat belts, helmet chin straps and oxygen masks were cinched down a little tighter and all emergency equipment double checked. The pilots lowered their sun visors, commenting on the improved visibility through the new visor as the navigation team conferred and requested a slight course alteration to place the BUF precisely on track. The EW noted the acquisition signals already displayed on his ALR-20 and rechecked his equipment and all instrumentation. Far behind, a lone fighter aircraft completed its climb and began closing. Almost simultaneously, a ground threat radar began illuminating the aircraft, the display shown clearly on both ALR-46 and ALR-20 receivers. The EW quickly noted that all equipment was properly configured as he reached forward and activated the Power Management System. Almost instantaneously, jammer packages appeared precisely over the threat radar signals. Some few minutes later, the ground threat radar went off the air and the EW noted the presence of the fighter. Warning was passed to the crew as the fighter closed to a range inside 3 NM and, after carefully double checking the firing solution, its pilot armed and fired a missile. Almost immediately, the EW noted a missile launch indication on the Tail Warning System, and watched for the time to go and range to impact countdown to begin.

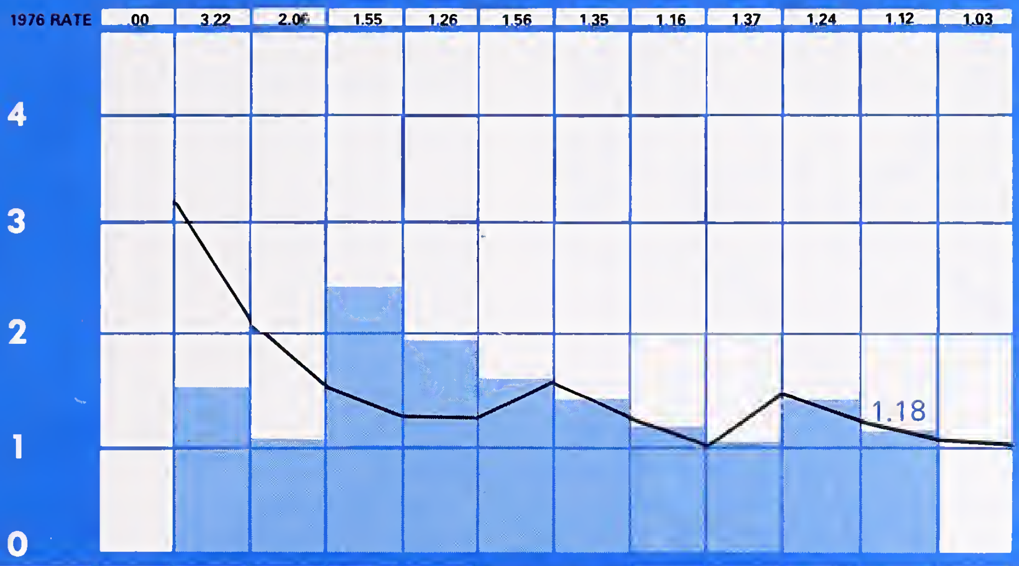
As those numbers became a blur, his attention focused on the master expendables panel, noting the dispense indications and then returned to other matters. As the missile passed safely below, the EW noted the activity of the past moments on his log and announced that the run was complete. With a sigh of relief, the copilot confirmed the completion of activity and noted again the quality of radio reception on his log.

As you have correctly surmised, this was not a mission over Vietnam or any other hostile territory. In fact, it was over the Eglin AFB test range. The tracking radar was a part of the test of a B-52 jammer Power Management System. The missile launch was not an error, but an intentional launch to evaluate a Tail Warning System proposed for B-52 and now FB-111 aircraft. The firing situation was closely controlled to insure safe aircraft/missile separation during all phases of flight. Also being evaluated were new flash blindness visors and a new ARC-164 UHF radio.

Continued on page 30

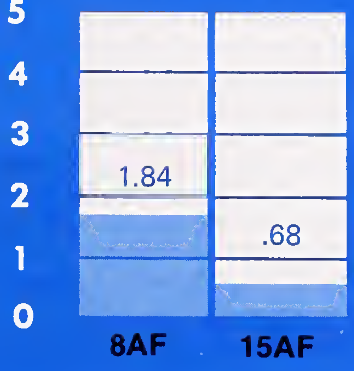
1977 Flying Safety Rate

SAC CLASS A MISHAP RATE (PER 100,000 FLYING HRS)



MISHAPS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1976	0	2	0	0	0	1	0	0	1	0	0	0
1977	0	1	0	2	0	0	0	0	0	1	0	

1977 SUBORDINATE CMD RATES



MISHAP STATUS

FB-111	FEB 77
B-52	APR 77
KC-135	APR 77
FB-111	OCT 77

LEGEND ⁀ =1976 RATE

ARCTIC KNOWLEDGE

Continued from page 7

Remove any one element and you will be without fire.

- Start with thin, fine dry materials, shredded birch bark, goats beard moss (black not the green) or wood shavings.
- Increase size of wood gradually, allowing each successive layer to ignite.
- Maintain adequate ventilation. Don't compact layers of wood and smother the fire.
- Warmth, light, drying clothing and equipment, melting snow and ice for water, cooking food, signalling, and morale are all dependent, to a degree, upon the survivor's ability to produce and maintain a fire.

This is only a guide to firecraft. "Hands-on" practice is the only way to develop the necessary skills to insure your ability to maintain your body heat through the use of survival fires.

SHELTERS

Shelters in the arctic are designed to afford effective maintenance of an individual's body temperature with a minimum amount of energy expended. Careful shelter site selection, available materials, and the proper shelter for the type of weather are the three factors the survivor should consider.

In selecting an area to construct a shelter it is necessary for a survivor to consider his safety as well as his needs. Natural hazards such as avalanches, high winds, water fluctuations, and cold sumps are just a few dangers that may be encountered. The survivor should also, at the same time, evaluate his basic survival needs. These needs consist of food, water, fuel, adequate signaling area, and building materials. With his safety and needs satisfied the survivor is ready to begin the construction of his shelter.

In the arctic, shelter construction is based on the thermal principle. There are two basic concepts of this principle. First, the use of the insulation quality of dry snow derived from the mass of relatively dry, dead airspace enclosed between individual crystals. Second, the use of heat transfer from the underlying ground into the interior of the shelter when bare ground is exposed inside the shelter. With this principle in mind it is possible for a survivor to construct a shelter that will maintain a constant temperature of +10° F to +20° F even though the ambient air temperature is below 0° F.

Shelters are divided into those constructed within the treeline and those constructed on barren land to include the icepack. The primary difference is that of building materials. Treeline shelters are constructed of pole frameworks and covered with boughs and snow. A few examples are the thermal A-Frame, Thermal Wedge, and the Thermal Double Lean-To. Barren land shelters are constructed of blocks cut from compact snow. Some examples of these shelters are the Fighter Trench and Para Snow House. A Snow Cave may be dug from snow drift.

It is important that all shelters be kept large enough to provide room for the survivor and his equipment, yet not so large that the shelter is difficult to heat. All shelters should be completely sealed from the outside environment. If a heat producing device such as a small stove is used in these shelters, a ventilation hole becomes necessary.

WATER AND FOOD

We need as much and sometimes more water to survive in the arctic than in a summer desert. Each day we lose about 1 pint of water through respiration, about 1 pint through perspiration and about 2 quarts through excretion. A 2½% loss of body fluids results in up to 25% loss of efficiency in working and thinking. A 10% loss of fluid usually results in death. A 3 quart loss per day, replenished by 2 quarts per day results in a 10% loss in about 5 days. We must continually insure that we drink 3 to 4 quarts of **warm** fluids each day to maintain our body fluid level and prevent dehydration. To maintain our body temperature in cold environments it is necessary to maintain our intake of energy producing foods. Daily calorie requirements increase from 3500-4000 calories to 4500-5000 calories per day. Once signals are constructed, firewood gathered and the survivor safely sheltered, his daily calorie requirement decreases. During the first 12 to 24 hours of a survival episode, the calories are provided by the meal eaten just before and during the flight. After that the survivor must fall back on survival rations and food procured from the land. A survivor's diet should consist of a high percentage of carbohydrates (General Purpose Rations — 870 calories per can) during the first few days thereby allowing the body to adjust gradually to burning larger proportions of fats and proteins.

RESCUE AND SURVIVOR RESPONSIBILITIES

The most important member of a recovery force may well be the survivor himself. Rescue doesn't just happen . . . it is made to happen by YOU, the survivor! By applying the basic fundamentals already discussed in this article, you will be alive to be rescued.

Virtually anyone and everyone is a source of rescue. Don't hesitate to attract the attention of military or civilians that are in or around your area. It is the survivor's responsibility to initiate contact with recovery forces. As soon as there is an emergency, let everyone know that will listen to you. If possible, let them know who you are, where you are, altitude, heading, and your full intentions. Do this while still in the aircraft. Don't wait until you are on the ground relying on emergency transmitters which have limited range and battery life; especially with extreme cold conditions where the batteries may only last a few minutes.

Once on the ground, turn off all activated locator beacons to prevent the continuous tone from overriding all voice communications. Immediately establish a logical sequence of transmission to effect voice contact, and save battery life of the transceiver by using a Beeper-Talk-Listen-Cycle. To accomplish this transmit continuous tone for 15 seconds, transmit your call sign 2 or 3 times, and then monitor 15 seconds listening for a reply. Repeat this cycle 3 times consecutively. If a reply is not received, turn off the transceiver and wait until such time as you feel someone will be within transmission range. Caution: when the transceiver is not in use place the device between layers of clothing to prevent cold soaking the battery. While waiting for rescue mentally practice the vectoring technique in the event you are required to direct the recovery forces in your position.

Don't lose confidence in the rescue forces and attempt to walk out. Travel in the arctic is not recommended under most circumstances. The hazards and difficulties which may be encountered far outweigh the advantages of trying to return to civilization under a survivor's own power. The only time you should travel is to a safe position or one providing more resources and then only for short distances. A short distance for a survivor may be as little as 15 minutes walking time.

Use visual signals to enhance your chance of being spotted. An aircraft kept clear of snow serves as a ready made signal. Strip signals constructed from commercial or natural materials are designed to attract attention and possibly carry a message. To be effective, a strip signal should be placed so it can be seen 360° around and from as far away as the naked eye can see. It should contrast against its background, and have distinct straight lines and sharp corners. The absolute minimum size for a strip signal is 18 feet long and 3 feet wide, and should be larger if it is to be seen from any distance.

The winter arctic has many days with long hours of darkness and, therefore, some type of light will be highly beneficial, i.e., fire, flashlight, gyro-jet, MK-13 day/night flare, strobe light. All of these should be ready for use at a moment's notice and, except fire, activated only when the search party can see the signal or upon request of the SAR personnel.

In order for the rescue service to continue with a high rate of success in recovering downed aircrew members, the survivor must be trained, equipped, and prepared to accomplish the various tasks required of him to preclude his being a liability rather than an asset to the SAR system. In the final analysis, mental attitude can determine the success or failure of a survival ordeal.

Questions or comments concerning the information contained in the article should be addressed to 3636 CCTW, Operations and Requirements Branch (DOTO), Fairchild AFB WA 99011 or AUTOVON 352-5470.

PROFESSIONAL PERFORMERS

Individuals selected for these pages as SAC's top professional performers of the month are chosen from nominations made by all SAC units. Selection is made only after all nominations have been carefully screened and those chosen meet the highest standards of excellence outlined in SACR 127-2.

Crew E-110, 911 Air Refueling Squadron, Seymour Johnson AFB: (L-R) CP Capt Konstantin Volodzko, P Capt James S. Lehman, N Lt Russell W. Patterson, and BO SSgt James E. Robertson.

FLYING CREW

The number two fighter aircraft effected a contact and began to take fuel. After approximately two minutes the boom operator, Sgt Robertson, requested that the receiver visually check his switch in the ALL TANKS position. The receiver then confirmed the switch position. Sgt Robertson informed the receiver that he was venting fuel and the receiver initiated a disconnect. The venting stopped after the disconnect was made. The receiver recycled his air refueling system and was cleared to the contact position. After the next contact, the boom operator again noticed fuel venting and told the receiver who immediately started down in the envelope. As the receiver approached the lower limits, Sgt Robertson initiated a disconnect, but the boom did not disengage. The receiver then started to approach the forward and down envelope limits. After the disconnect was attempted, the tanker's pilot director lights went out leaving the receiver uncertain of his position. By this time, the receiver was passing 45 degrees elevation and a brute force disconnect occurred. The boom's initial trajectory was up, but as the boom operator was holding down pressure in an attempt to stay with the receiver, the boom went down snapping the boom hoist cable. Approximately 5-8 feet of cable wrapped around the ruddevators. The crew decided that it would be hazardous to fly the boom to the latched position due to the possibility of boom cable entanglement with the elevators. With Sgt Robertson flying the boom, Capt Lehman skillfully landed the aircraft. Due to the approach speed, the boom became unflyable just prior to touchdown and skipped into the foamed area. Sgt Robertson held it in that position. Because of the crew's professional actions, the boom received minimal damage and a serious aircraft mishap was averted.

MAINTENANCE MAN. SSgt Richard P. Soucy, 376th Avionics Maintenance Squadron, Kadena AB.

TITAN CREW E-054, 390 SMW, Davis-Monthan AFB: MCCC 1Lt Friedrich Peyerl, DMCCC 1Lt Mark B. Stevens, BMAT A1C Dale R. Myers, and BMFT SrA Julian Sanchez.

MINUTEMAN CREW E-085, 91 SMW, Minot AFB: MCCC Capt William P Jacobsen, and DMCCC 1Lt Glenn D. Wright.

A Chief of Safety Speaks

Major Walter A. Marshaleck, Jr.
Chief, Safety Division
19BMW, Robins AFB

If you are a wing or an additional duty safety manager, you have a great deal of latitude in the management of your safety program, but the responsibility is yours. How well you perform your duties is related, to a large degree, to your management ability. At times, the tasks that are required to be accomplished may seem to be more than one person can handle; that happens often. A key to managing your resources — people, money and machines — is to somehow get each individual within your unit directly involved in the safety effort.

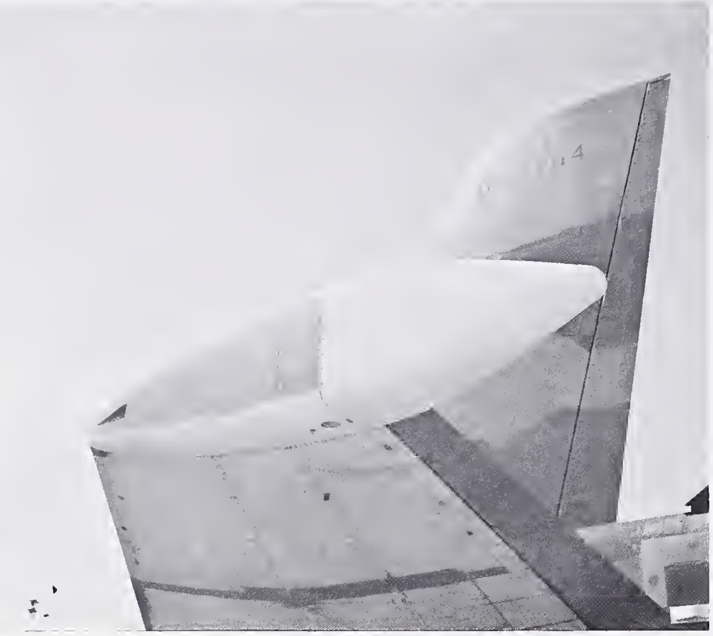
Your commander is an essential ingredient in a successful safety program. He can be the most powerful single force that you have available to get people involved with safety. When you have a problem or are convinced that action should be taken, take that action and let your commander know. Give your commander a break; do him a favor by doing your homework first. When presenting a problem or when asking for his support or action, provide him with some solutions and possible courses of action. You can gain your commander's respect, and in a lot of cases his appreciation, if you make your decisions at the proper level. Bring your commander only those problems that cannot be resolved at a lower level.

The successful safety manager must be part salesman; the bigger the part, the better. You must convince your people that being safe is being smart. Insure that your people understand the importance of safety and that the safe way is the right way. Set a good example by being a model to the rest of the unit.

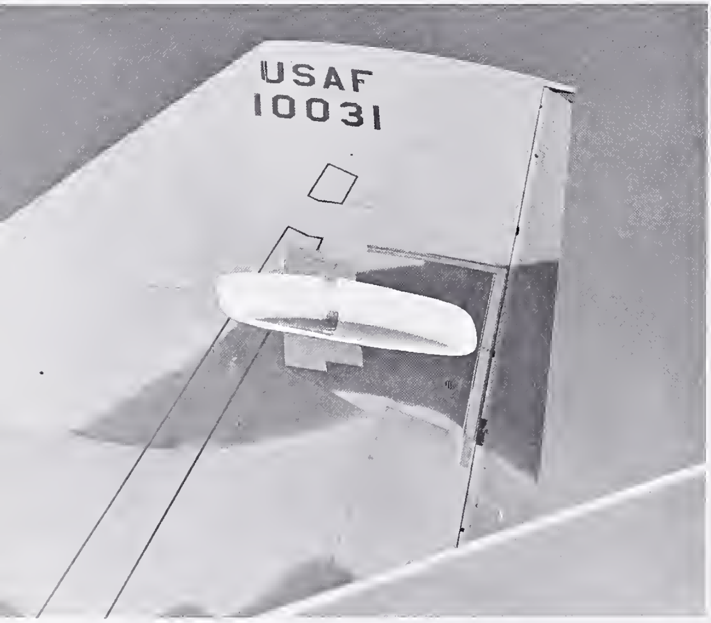
Get the word out. That safety bulletin board is a good advertising tool, but it should not be the only way you communicate with your people. Get out and talk safety to as many people as you possibly can. Radiate enthusiasm for your program and know all or most of the people in your unit.

In the 19th BMW we have a people oriented recognition program that may be of use in your wing. The names of safety managers who have performed in an outstanding manner are announced at the wing standup briefing. Each safety manager has the chance to be the Wing Safety Manager of the Month. In addition, we emphasize the Commander's Safety Award program and the unit safety managers certainly have an influence on their unit's receiving that award.

The success of our primary mission depends on many factors that contribute to getting the job done. Safety is absolutely essential. Without it the job would not get done.



AN/ALQ-127 tail warning installation as proposed for left horizontal stabilizer of B-52 G/H aircraft in 1973.



AN/ALQ-XX tail warning installation for B-52 G/H aircraft as flight tested in 1977 and proposed for future modification.

r&d corner

Continued from page 24

Interested in these or the other development programs mentioned above? Read on!

Considerable time, effort and funding is being expended by the Air Force to insure timely equipment updates to Strategic Air Command weapons systems. This is a time consuming process, frought with many obstacles. It usually leads to improved operational capabilities for the SAC bomber and tanker fleet. This does not always occur as rapidly as most of us would like. Consequently, this column is being developed to tell where modifications are in the development cycle, and most importantly when you can expect to see them in the field. Some discussion of the development/acquisition cycle will be included.

Future issues of your *Combat Crew* Magazine will address new equipments being managed by the Directorate of Aeronautical Requirements in an attempt to keep you, the ultimate user, informed of equipment development and the acquisition life cycle as equipments proceed from the conceptual phase through development to IOC. Because of the classified nature, your attention will be called in certain instances to classified test reports, supplementary documents and you will be told where to find them.

What about the programs above? The Tail Warning System was requested almost a decade ago with the first iteration (AN/ALQ-127) not meeting stringent Air Force requirements. The equipment currently being competitively developed by Westinghouse (AN/ALQ-153) and AIL (AN/ALQ-154) has completed its competitive flyoff with Source Selection scheduled for completion in Jun 78. We feel so strongly about the worth of this program that the new Tail Warning System also has been selected as a replacement for the aging AAR-34 warning receiver on our FB-111 aircraft. The engineering studies have begun for this to be a parallel effort with the F-15. The requirement for Power Management of ECM transmitters is a bit newer: 1974. Production contract award is planned for early 1978. The ARC-164 radio is scheduled for use in both B-52 and FB-111A aircraft, but that, in addition to new flash blindness equipment and the genesis and life cycle of development hardware, is a story for another day.

Next month: The FB-111H prototype story.

SAC SAFETY SCREEN

5BMW, Minot Crew E-15: P Capt Dana B Demand, CP 1Lt Lawrence P Elfering, RN Capt Charles I Bennett III, N 1Lt Michael L Fletcher, EW 1Lt Stephen Scolnik, G SrA Rizz E Pittman Jr

7 AREFS, Carswell Crew E-126: P Capt Steven C Brunner, CP 1Lt Joseph D Shine, N 1Lt Charles W McMillan, BO Sgt Wayne C Isaacson

9 BMS, Carsell Crew E-52: P Capt Charles D Hillebrand, CP 1Lt Raymond R Powell, CP 1Lt Dennis A Mitchell, RN Capt John W Silas, N Capt Richard L Lenz, EW Capt James J Stoeckles, G A1C Arthur T Gebbia

20 BMS, Carswell Crew S-09: P Capt David L Lay, CP 1Lt Luther S Martin, RN Capt Richard E Vandevorde, N Capt John T Turner, EWO Capt Gary E Henley, G Sgt Billy J Bouquet

28 BMW, Ellsworth Crew S-101P: IP Capt Jerry L Wetherbee, CP Capt Kenneth D Lorenz, CP 1Lt Winfield H Smith, IN Capt Mark N Amundsom, IBO SMSgt John L Huebner

44 SMW, Ellsworth Crew E-163: MCCC Capt Ronald C Steed, DMCCC 1Lt Thaddeus Jablonski

62 BMS, Barksdale Crew E-19: AC Capt Andrew C Hutter Jr, CP 1Lt Albert W Day, RN Capt Gary H Fischer, NN 1Lt Steven N Marin, EW 1Lt Franklin W Slagle, AG Sgt Ronald G Tollison

71 AREFS, Barksdale Crew R-156: P Capt Mack L Oldham, CP 1Lt Donald D Maxwell, N 1Lt Rodger E Burkley, BO SSgt Hiram D Bonner

90 SMW, F E Warren Crew S-201: MCCC Capt Dennis J Murphy, DMCCC 1Lt Claude A Bloom

340 AREFG, Altus Crew S-101: P Capt James G Dickensheets, CP 1Lt Wright W Diamond, N Capt George L Burrus, BO CMSgt Dale O Rosnett

157 AREFG (ANG), Pease AFB: P Capt William W Rowell, CP Capt Thomas J Bunting, N Capt Alfred Ferruolo, BO MSgt Raymond C Richardson

308 SMW, Little Rock Crew R-111: MCCC 1Lt James F Valigura, DMCCC 2Lt David A Duroure, MSAT A1C Robert C Hewitt, MFT SrA George F Presnell

329 SMW, Grand Forks Crew E-095: MCCC Capt Charles L Bouboulis, DMCCC 1Lt John M Copeland

341 SMW, Malmstrom Crew S-203: MCCC Capt Leon G King, DMCCC 1Lt Donald P Pettit

351 SMW, Whiteman Crew R-013: MCCC 1Lt Nicholas F Ewing, DMCCC 2Lt John P Moore

381 SMW, McConnell Crew R-111: MCCC Capt Henry J Schulte, DMCCC Lt Charles W Gross Jr, MSAT A1C Stephen C Moore, MFT TSgt John E Kidd

4018 CCTS, Carswell Crew ST-12: IP Maj Ryamond Klaehn, IRN Maj Darold A Klamt, IEW Maj Bobby J Dickens, IG TSgt James H Crews Jr

596 BMW, Barksdale Crew S-64: P Capt Ross H Younkin, CP Capt James R Macon, RN Capt Jimmy L Cowart, N Capt Antoine J Treadaway, EWO 1Lt Mark S Ashton, G Sgt Howard Williams

913 AREFS, Barksdale Crew R-112: P Capt John C Edwards, CP 1Lt Lawrence J O'Keefe, CP Capt Richard S Runyan, N Capt Gary D Ogburn, BP Sgt Charles Wyounce

★ U.S. Government Printing Office:
1977-765-129/11

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HALL OF FAME

TACTICAL FLYING

OVER TWENTY-ONE YEARS

170 AREFG, McGuire (NJANG)	NONE

OVER NINETEEN YEARS

171 AREFW, Greater Pittsburgh (PAANG)	Mar '58
157 AREFG, Pease (NHANG)	Jun '58
97 BMW, Blytheville	Aug '58

OVER EIGHTEEN YEARS

940 AREFG, Mather (USAFR)	May '59
307 AREFG, Travis	Sep '59

OVER SEVENTEEN YEARS

19 BMW, Robins	Oct '60

OVER SIXTEEN YEARS

151 AREFG, Salt Lake City (UTANG)	Feb '61
161 AREFG, Sky Harbor (AZANG)	Apr '61
126 AREFW, Chicago O'Hare (ILANG)	Apr '61
134 AREFG, McGhee Tyson (TNANG)	Aug '61

OVER FIFTEEN YEARS

340 AREFG, Altus	Feb '62
301 AREFW, Rickenbacker	Jul '62
96 BMW, Dyess	Aug '62

OVER THIRTEEN YEARS

160 AREFG, Rickenbacker (OHANG)	Dec. '64

OVER TWELVE YEARS

136 AREFW, Dallas NAS (TXANG)	Jun '65
320 BMW, Mather	Jul '65

OVER ELEVEN YEARS

452 AREFW, March (USAFR)	Sep '66

OVER TEN YEARS

92 BMW, Fairchild	Feb '67
55 SRW, Offutt	Jul '67
2 BMW, Barksdale	Aug '67
319 BMW, Grand Forks	Dec '67

OVER NINE YEARS

22 BMW, March	Feb '68

OVER EIGHT YEARS

5 BMW, Minot	Feb '69
42 BMW, Loring	Sep '69
141 AREFW, Fairchild (WAANG)	Oct '69

OVER SEVEN YEARS

28 BMW, Ellsworth	May '70

OVER FIVE YEARS

7 BMW, Carswell	Mar '72
101 AREFW, Bangor (MEANG)	Mar '72
416 BMW, Griffiss	May '72
305 AREFW, Grisson	Aug '72
376 SW, Kadena	Nov '72

OVER FOUR YEARS

379 BMW, Wurtsmith	Apr '73

ICBM

OVER FOURTEEN YEARS

381 SMW, McConnell	Nov '63

OVER THIRTEEN YEARS

90 SMW, F E Warren	Jul '64
1 STRAD, Vandenberg	Sep '64

OVER TWELVE YEARS

308 SMW, Little Rock	Aug '65

OVER SEVEN YEARS

341 SMW, Malmstrom	Apr '70

OVER FOUR YEARS

390 SMW, Davis-Monthan	Jul '73

To gain listing in the Hall of Fame, a SAC or ARF unit must be Class A mishap-free for 48 months.